ENVIRONMENT, SAFETY & HEALTH

SAFETY ALERT

Assistant Secretary for Environment, Safety & Health • U.S. Department of Energy • Washington, DC 20585

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Chemical Explosion at Hanford

The purpose of this notice is to advise you of a serious event so that you will take appropriate actions at your facilities to avoid a similar occurrence.

On May 14, 1997, an explosion occurred in the Chemical Preparation Room of the Plutonium Reclamation Facility (PRF) at Hanford's Plutonium Finishing Plant (PFP). PRF has been shut down for several years and will be deactivated in preparation for decontamination and decommissioning. The explosion occurred in a room where non radioactive bulk chemicals were mixed to support the now discontinued plutonium recovery process.

Initial indications are that a spontaneous reaction of hydroxylamine-nitrate and nitric acid mixture was the cause of the explosion. The hydroxylamine-nitrate/nitric acid tank is a 400 gallon stainless steel tank. The tank initially contained a relatively dilute solution of hydroxylamine-nitrate that was prepared for a training exercise in 1993. Concentrations of the reactants increased due to evaporation from this vented tank over an extended period. The explosion caused the bolted lid of the tank to be blown off and a 1½ inch fire protection water line to rupture, allowing water to flow through the plutonium facility and to the parking lot. Structural damage included deformation of a wall, damage to doors, and two small (~6") holes in the roof. No injuries occurred. PFP initiated an unreviewed safety question because of damage from the event. An investigation of the event is in progress, and early indications are that shift surveillance data gathered since 1993 indicated a trend of weight loss, which could indicate a concentration change had taken place in the tank's contents. The significance of that indicator was not recognized.

An autocatalytic reaction in a piping system was postulated as the cause for an event that occurred at the PUREX Plant in 1989. A solution of hydroxylamine-nitrate and nitric acid with hydrazine was trapped between two valves. This mixture likely concentrated over time, and the ensuing reaction ruptured a gasket. Testing at Westinghouse Hanford Laboratory determined that an autocatalytic reaction would occur if this solution was sufficiently concentrated by evaporation. Hydrazine was not involved in the May 14th explosion.

Facilities in a shutdown, transition, or deactivation mode may present hazards that are not present in active facilities. Chemicals remaining in shutdown vessels, piping, drums or other storage locations may be subject to long term changes due to degradation or concentration. The condition of chemicals should be considered in light of potential long term changes, even though the safety of the active process systems has been analyzed and assured. These longer term changes could potentially lead to spontaneous reactions. Examples of such changes are:

- Corrosion product catalyzed reactions
- Slow chemical degradation
- Concentration by evaporation
- Inadvertent cross contamination (system leaks, misroutings, etc.)

The DOE Chemical Vulnerability Assessment identified concerns with the storage of chemicals throughout the Department. In addition, the vulnerability assessments for plutonium and highly enriched uranium highlighted concerns associated with the long term degradation of solutions. Corrective action plans were formulated.

Facility managers and DOE Operations Office managers should review their vulnerability assessment corrective action plans, the issues in this alert, and surveillance data to ensure they have a good understanding of the hazards from their chemical inventories and are responding appropriately. In addition, as facilities transition from operation to deactivation, managers should be cognizant of requirements in the Resource Conservation and Recovery Act.

Should you have any questions on this matter, please contact Donald Harlow at 301-903-4508.

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